BALUN Matters

In this month's column, **Keith Rawlings** tests a balun transformer that has come to him from the other side of the world, recommends a homemade alternative and responds to some reader feedback.

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You may remember that in last month's column (*RadioUser*, July 2018: 46-48) I described a simple random wire end-fed aerial for HF and mentioned the use of a BALUN/transformer at the feed point.

A BALUN (balun) is a type of electrical transformer used to connect an unbalanced circuit to a balanced one. The use of one of these is often very advantageous, for two main reasons.

First, it helps to bring the feed point of the wire to something nearer 50Ω.

Second, it allows the use of a screened coaxial cable to bring the feed point into the shack or operator's position; it can also help to reduce electrical noise in the system.

The internet is full of designs for baluns, suitable for use with an end-fed aerial. They are sometimes called 'magnetic long wire baluns' or 'matching transformers' I have even seen them called 'chokes'.

The cost of making one will depend on the components used and, to a certain extent, on how well equipped your 'junk box' is.

For those unable or not ready to make one, there is always the option to buy; there are many types of baluns available, either on auction sites or from the dealers who advertise in *RadioUser*.

Long-Distance Balun

Going for the cheap option, I took a look at a certain auction site and found a "*100K-50MHz RTL-SDR Transformer Balun BNC Supporting long Antenna 9:1 Impedance*" for the princely sum of £3.80, including delivery. I ordered one and, within weeks, it had found its way from the other side of the world to my letterbox.

On inspection, it was identical to the one in the auction photo (Fig. 1).

In life, you get what you pay for and it was immediately obvious that this was also the case here.

The terminal post was definitely at the cheaper end of the quality scale, as was the box. The BNC socket looked reasonable and the soldering was fine. The windings of the transformer were a bit untidy. I was unable to identify the type of ferrite ring used without removing the winding and testing.

However, I would not like to have to buy the components, make one, and then ship it around the world, for the sort of price I paid.

It appeared that the balun was based on a design by Italian amateur I6IBE. Now, whether it is with that amateur's permission, or whether his intellectual property has been lifted off the internet, I do not know.

However, the toroid used is certainly not the T200-2 as used in I6IBE's design but a T50-something!

I checked the SWR on an antenna analyser and the results – taken at random frequencies – are shown in Table 1.

As you can see, they are acceptable. However, below 1.5MHz, things are starting to not look too good.

I also checked the ratio using a variable resistor connected across the input and ground and found it measured 9.4:1.

The Balun in Use

In use, the balun performed adequately well. I connected it to the base of my 66ft inverted-L aerial, with the coaxial cable feeder running back into my shack.

On the mid-HF to medium wave bands, I was happy with its performance, although, on the latter, the signals were down a couple of S-points, compared to the transformer I use (see later).

For use below HF, this balun would not be my first choice but would still be serviceable.

It was difficult to asses its performance on the upper HF frequencies because band conditions were poor at the time. Nevertheless, based on the figures in Table 1, I see no reason why its performance should not be adequate. Overall, my balun did the job well and was worth the money.

1.5MHz	1.7	10MHz	1.0
3.0MHz	1.3	14MHz	1.0
5MHz	1.1	20MHz	1.1
7MHz	1.1	30MHz	1.3

Table 1: Checking SWR on my antenna analyser.

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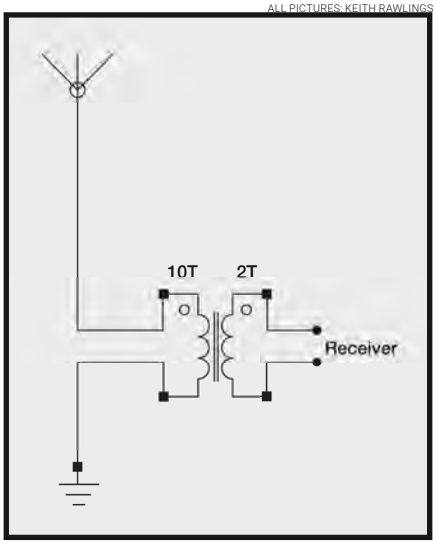

Fig.1: My Balun transformer.

As long as the balun was kept dry and out of the weather, it was perfectly operational as it was.

Due to its size and weight, it was also ideal for temporary or portable operation.

For experimenters, you have everything you need, except for a length of suitable, insulated, copper wire.

Make Your Own

At present, I use a homemade transformer based on my design previously published in the September 2016 issue of this magazine (*RadioUser*, September 2016: 58 to 63). This is used on my inverted-L aerial.

This version consists of ten turns of wire on the input and two turns on the output to the receiver, wound on an BN73-202 binocular core with a ratio of 20:1. It is of a different format to the eBay item (Fig. 2).

The use of a 73 core is to give me better results at the lower end of the spectrum. This design is intended for use down to 500kHz, although performance should still be good well below this.

A design for a lower frequency of 100kHz would have 23 and 5 turns respectively.

With this transformer, the aerial system

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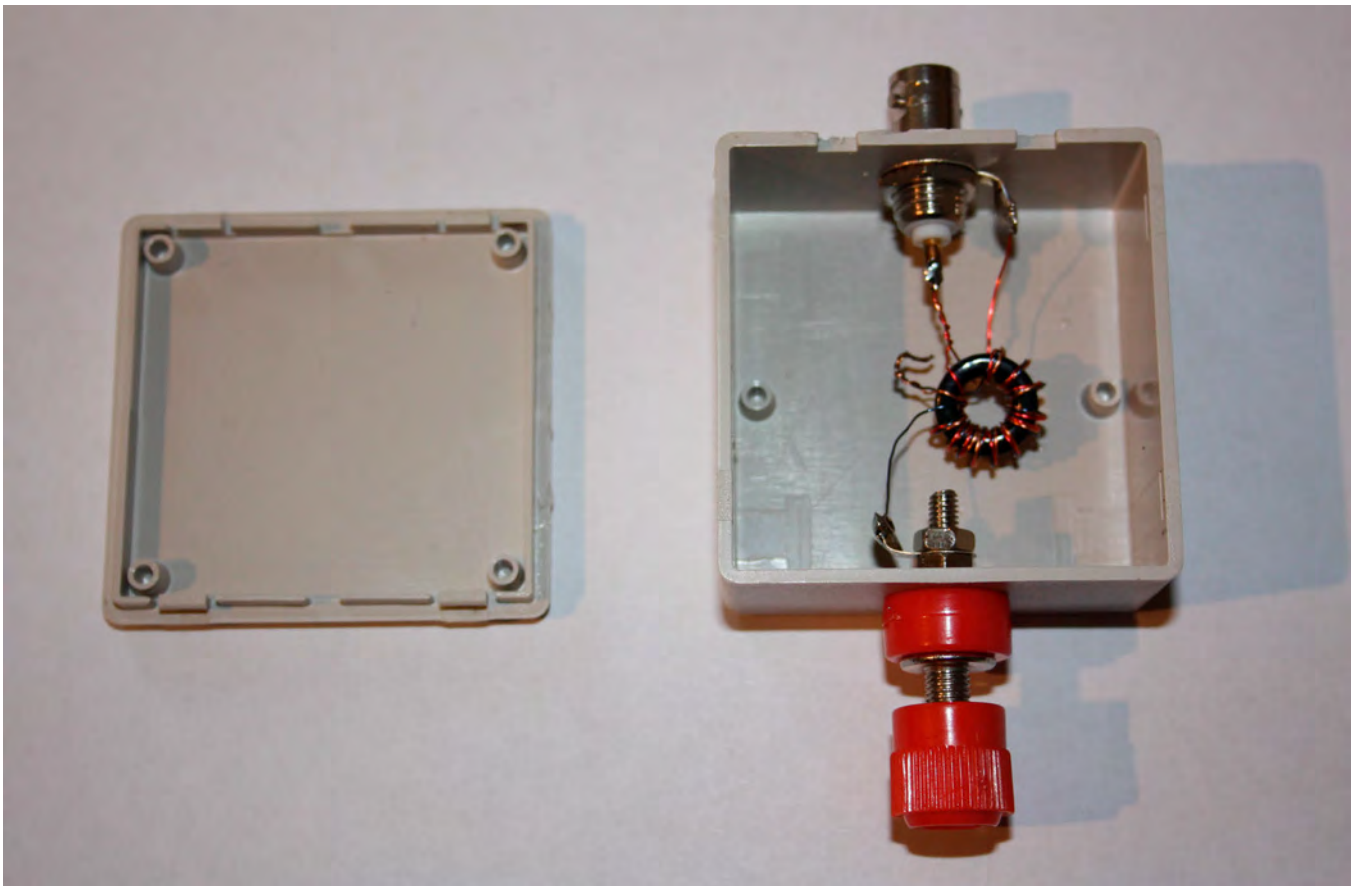

Fig. 2: Home-made Balun transformer (cf.: *RadioUser*, September 2016: 58-63).

can be provided with a ground, as the transformer gives electrical isolation. It also provides a DC path to ground. Therefore, any build-up of static is 'dumped' to earth.

Tests have shown that, below approximately 2MHz, electrical noise is also much reduced, although, admittedly, the effect of this may depend on your location and the type of noise you experience.

The wire used on the transformer should have good insulation and be thick enough to withstand static discharges. Moreover, in order to keep the isolation, the housing should be non-conducting such as the kind you find in a plastic box.

Bear in mind last month's link to the RSGB PME information, in regard to the insulation of the windings of the transformer between a ground earth and your mains earth.

My present transformer has 28 standard wire gauge (SWG) enamelled copper wire, which has reliably stood up for a number of years. Notwithstanding this, I always make a point to disconnect the aerial when not in use, especially so during stormy weather.

The image in Fig. 3 shows the balun casing, with the weather shield removed.

The inside of the box can be seen in Fig. 4.

The box is not sealed around its base. Therefore – as moisture may get in – it has a small opening at the bottom to allow it to get out again.

I use a weather shield made from the bottom of a 2-litre plastic milk carton, cut so that I can place it over the box. These cartons do degrade, especially in sunlight, so you will have to keep an eye on things (Fig. 5).

To get an idea of the construction layout of the transformer, Fig. 6 shows a similar one on a test jig.

As mentioned above, more detailed information can be found in the September 2016 edition of *RadioUser* (cf. above). However, if anyone requires more detail, please let me know and I will try to include this in my future columns here.

Feedback.

I received an email from Bob Houlston G4PVB, providing me with a link to the design for a folded dipole that he thought readers might find interesting and which can be found at this URL:

http://g4pvb.eu5.net/2m.htm

This is a very simple design, made from bits of wire and a choc block connector.

A folded dipole has the advantage of having a wider bandwidth than an ordinary one. In this design, there is no direct connection to the outer screen of the coaxial cable. This reduces the chance of noise on the feeder getting back to the receiver.

However, if anyone requires more detail, please let me know and I will try to include this in my future columns here

With the dipole's impedance being in the region of 270 to 300Ω, the transformer (or balun) is required.

This design is for 144 to 146MHz but can easily be replicated for other frequencies; there are numerous design-calculators to be found on the internet.

Be warned, however, that, if you connect a coaxial cable directly to the fed point (without the 4:1 balun) you will get a VSWR of around 6:1.

Further reading may be found here:

https://tinyurl.com/yd33tsw7

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Fig. 3: The case of my home-made Balun, with the weather shield removed.

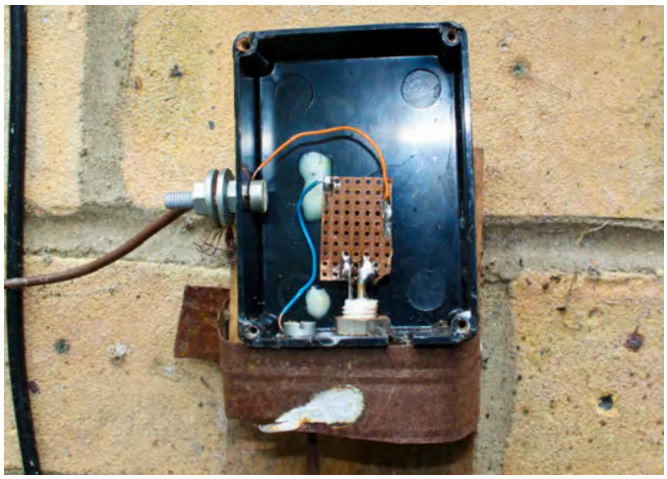

Fig. 4: An inside view of my home-made Balun.

If anyone has a go at building one, please let me know how you got on. In addition to this, Ray, from France, contacted me about a number of subjects in the June issue.

One such issue concerned my polar plots, the main intention of which was to acquaint readers to their existence and format, rather than to imply meaningful figures at the time.

And yes, the figures given were of a Yagi over ground.

Figure 5 in my June column (*RadioUser*, June 2018: 11) was meant to demonstrate how 'imbalance' could be introduced into a system by nearby objects. Man-made noise is, indeed, a topic for future articles.

Another subject I covered was gain. In this context, Ray states *"For receiving in HF, we want the best S/N more than the strongest S"*.

I agree; the signal-to-noise-ratio is important at any frequency. Gain – or the lack of it – is just as relevant at HF as it is at VHF/ UHF.

For example, by using figures of gain, we can evaluate one aerial in comparison with another one.

One design, often used on HF, is the double-extended Zepp (*Zeppelin*) aerial, which demonstrates a useful 3dB gain advantage over a dipole (and may well be the subject of future discussion).

Fig. 5: My 'milk carton weather shield'.

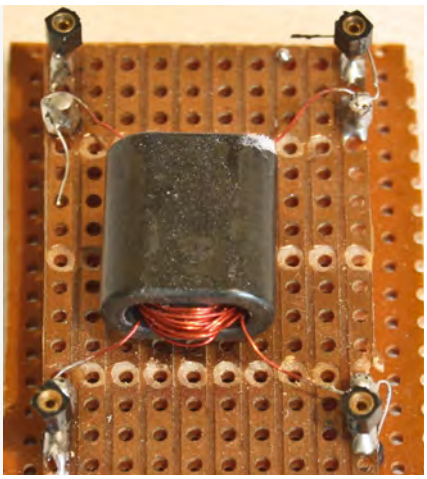

Fig. 6: A Balun transformer on a test jig.

Furthermore, I hope that last month's column adequately addressed your comments on 75Ω cables.

As a follow-up to last month's article (in which I mentioned counterpoises) Jon Hudson from SDRPlay has placed a video on YouTube, demonstrating the impact of using a simple counterpoise. Here it is:

https://tinyurl.com/y9hlvnex

In next month's column, I am aiming to include an aerial review.

I will also discuss basic safety aspects and, of course, reply to your comments. As always, good listening and best wishes.

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